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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/912,558	07/26/2001	Ronald A. Weimer	M4065.0319/P319-A	5990

24998 7590 02/15/2002

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EXAMINER

KIELIN, ERIK J

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 02/15/2002

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/912,558

Applicant(s)

WEIMER ET AL.

Examiner

Erik Ki lin

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 January 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 13-42 is/are pending in the application.
- 4a) Of the above claim(s) 18-40 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 13-17, 41 and 42 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 November 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3. 6) ☐ Other: _____

DETAILED ACTION***Election/Restrictions***

1. Applicant's election with traverse of Invention I, species Ia, in Paper No. 9 is acknowledged. The traversal is on the ground(s) that the search would allegedly not cause undue burden of search for Examiner. This is not found persuasive because burden of search has already established by the different classification of inventions I and II drawn to gate dielectrics and capacitor plates, respectively, which are completely distinct structures in semiconductor devices and accordingly require divergent searches. This imposes undue burden to search.

Furthermore, elected species Ia is drawn to *wet* oxidation further limited by a temperature, time, and the dielectric gate materials oxidized, whereas non-elected species IIb is drawn to the many various means of *steam* oxidation, including bubbling water (claim 21), pyrogenic (claim 22), catalytic (claim 23), *in situ* steam generation (claim 24), various hydrogen-oxygen concentrations to generate the steam (claims 19-20) and then further performing a stabilizing heat treatment in a required ambient (claim 25), each group of which is a different species in and of itself. It would create undue burden to search all known methods of steam oxidation --especially as applied to already formed gate dielectrics of specified material and dielectric constant.

Further in regard to the species restriction, Applicant did not properly provide evidence or otherwise clearly admit on the record that the species Ia and Ib (or IIa and IIb) were obvious variants, said evidence or admission which could have been used to properly traverse the species restriction, as indicated in the previous action. Inasmuch as Applicant has not admitted on the record that the species are obvious variants, it appears that Applicant is admitting that each

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species is, instead, patentably distinct which only bolsters Examiner's position that the search of each variant would create undue burden.

The requirement is still deemed proper and is therefore made FINAL.

Accordingly, elected species, Ia, claims 13-17 and newly added generic claims 41-42 will be examined and claims 18-25 are withdrawn from further consideration as drawn to a non-elected species, there being now allowable generic or linking claim. Claims 26-40 are withdrawn as being drawn to a non-elected invention.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

3. Claims 13, 15-17, 41, and 42 are rejected under 35 U.S.C. 102(a) as being anticipated by the article **Luan**, et al. "Ultra thin high quality Ta₂O₅ gate dielectric prepared by in-situ rapid thermal processing" Electron Devices Meeting, held 6-9 December 1998, IEDM '98 Technical Digest, pp. 609-612.

Regarding independent claims 13, 41, and 42, **Luan** discloses a method of forming a gate dielectric layer on a substrate comprising the steps of

depositing a dielectric film over an active region of a semiconductor substrate to form part of a gate of a transistor, wherein the dielectric film is tantalum oxide (Ta₂O₅), as further

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limited in claim 17, having the inherent property of a dielectric constant of "at least about 25"

(Introduction), as further limited in instant claim 16; and

subjecting the dielectric film to a wet oxidation using rapid thermal processing (RTP) and therefore occurring, by definition, in a RTP chamber, at a temperature of 600 °C for a period of about 40-50 seconds (Fig. 1) as further limited in instant claim 15, wherein the wet oxidation environment is formed by heating a mixture of H₂ and O₂. (See whole **Luan** article which is very brief.)

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Luan** in view of US 6,063,698 (**Tseng et al.**).

The prior art, as explained above, teaches all of the features of the claims except for indicating a temperature in the range of 750-950 °C.

Tseng teaches a process virtually identical to **Luan** of forming a tantalum oxide gate dielectric 14 on a semiconductor substrate 12 and then wet oxidizing by heating a mixture of H₂ and O₂ to a temperatures of 750-850 °C to beneficially "eradicate trap sites 16 and 18" (col. 6, lines 39-57). (See also Abstract; col. 5, line 54 to col. 6, line.)

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It would have been obvious to one of ordinary skill at the time of the invention to modify the method of **Luan** to use the temperature taught by **Tseng** in order to beneficially reduce the trap sites as taught by **Tseng**. --especially since the methods are virtually the same.

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 6,197,668 B1 (**Gardner et al.**) teaches a Ta₂O₅ gate dielectric which is RTA processed after deposition in NH₃ at a temperature of 900-1100 °C. (See col. 3, lines 39-66.)

Lu et al. "Leakage current comparison between ultra-thin Ta₂O₅ films and conventional gate dielectrics" IEEE Electron Device Letters 19(9), 9/1998, pp. 341-342 teaches a Ta₂O₅ gate dielectric which is RTA processed after deposition in NH₃ at a temperature of 800 °C for 30 seconds. (See Abstract and section entitled "Fabrication.")

Alers, et al. "Intermixing at the tantalum oxide/silicon interface in gate dielectric structures" Applied Physics Letters 73(11), 14 September 1998, pp. 1517-1519 teaches a Ta₂O₅ gate dielectric which is RTA processed after deposition in O₂ at a temperature of 800 °C. (See Abstract; Fig 1; p. 1519, first paragraph.)

US Patent Application Publication 2001/0020725 A1 (**Okuno et al.**) teaches a Ta₂O₅ gate dielectric which is RTA processed after deposition in O₂ or N₂ at a temperature of 700 °C for 60 seconds. (See paragraph [0032].)

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached at 703-306-2417. The fax phone numbers for the organization where this application or proceeding is assigned are 703-306-7722 for regular communications and 703-306-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-306-3431.



Erik Kielin
February 9, 2002